

Research on OSS contributions within the automotive and the embedded systems industry (GENIVI / PolarSys)

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Agenda

- > Introduction
- > Research question & method
- > Case study
- > Results
- > Discussion, limitations and further research

Introduction (1/2)

> Individual motivation to contribute to OSS

- Motivation of individuals to contribute to OSS varies¹
- Intrinsic reasons: Ideology, Altruism, fun
- Internalized extrinsic: Reputation, learning, own use
- Extrinsic: Career, money

> Increasing interests of organizations

- Increasing investments in collaborative software development²
- Mostly initiated by software companies

“companies get involved in collaborative software development to advance business objectives and to be part of industry innovation²”

Introduction (2/2)

> **Vertical domain**

- Aim to address the needs of a specific industry or market
- Dentist-office software, library-software, ERP-system for higher education institutions
- Compared to horizontal domain, examples are rare¹.

> **Horizontal domain**

- Address the needs of different industries or markets
- OS, DMS, DB
- Most OSS projects target the horizontal domain

Research question and method

For what reasons do organizational users develop OSS within the vertical software industry?

> Method

- Case study research: Enable in-depth views, allowing causal relationships, underlying motivations¹
- Based on two data sources: semi-structured interviews with key representatives and several public documents

Case Study: GENIVI

> GENIVI

- OSS development platform for Infotainment systems
- Reducing development costs, Faster time to market
- Background: OSS was new in this industry
- Founded in 2009, over 180 members¹



> PolarSys

- Create and support OSS for embedded systems within the aerospace industry, energy sector and more
- Enable collaboration between end user companies
- Founded in late 2011, more than 20 members²



POLARSys

Open Source Tools for Embedded Systems

Results: Cost reduction

> **Cost reduction through collaboration**

- A complex Infotainment system can reach costs of millions \$
- General demand for commodity software in vehicles
- Goals: Reduce development & maintenance cost
- Collaboration facilitates cost reduction by sharing the cost of common requirements.

Results: Lower supplier dependency

> Lower supplier dependency

- Traditional approach: select a software supplier and require a solution.
- The delivered product was a black box, car manufacturers had to buy this repeatedly → high supplier dependency.
- Change: Transparency in the development process.
- Enable code reusing across multiple products and companies → less dependent on a specific software provider.

“They wanted to be able to bring the box that they purchased from their software provider in-house and to be able to distribute the development of that box to multiple partners and create more competition in this market.”

Results: Reducing time to market

> Reducing time to market

- Fast moving smartphone industry:
 - Customers expect the same technical standard in their cars.
- But: Time-to-market for smartphones (12-18 months) is significantly shorter than time for cars (3-5 years).
- code reusing → time to market decreased.
- Car manufacturers can reuse the code for further products, as BMW does it in several lines by reusing the GENIVI software stack¹.

“BMW has already launched its second generation production program and is well ahead of where it would have been if it were using a traditional software delivery method.”

Results: Long term support

> Long term support

- Required by products with an operational life cycle of 20 to 50 years or more, PolarSys provides support throughout this time.
- The first ten years of support (LTS) is reached with the help of the LTS working group of the Eclipse foundation¹
- The VLTS is specific to PolarSys and has to run for several decades. One aspect of this VLTS is to freeze the software version and be able to restore it several years later in order to fix potential bugs.
- In order to ensure the sustainability of the software and to meet VLTS, PolarSys & Eclipse Foundation together built a thriving community.

“It is not yet known precisely how support and virtualization spanning several decades will be provided.”

Results: Sustainability

> **OSS as a solution to sustainable software**

- If a proprietary software provider stops the investments in a product or the company leaves the market, the sustainability can no longer be ensured.
- Interviewee: Airbus and others see OSS as the only solution for long term software support since it is unlikely that a single company can maintain a software for several decades.
- OSS helps PolarSys to ensure sustainability. The source code remains even after several members disappear.
- PolarSys aims to include the major contributions in newer software releases, rather than different members using different patches that will eventually become incompatible with the software.

Summary and discussion

- > **RQ: For what reasons do organizational users develop OSS within the vertical software industry?**
 - Cost reduction through collaboration
 - Lower supplier dependency
 - Reducing time to market
 - Long term support
 - OSS as a solution to sustainable software

Thank you



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Appendix

#	Name, function, association	Type	Date	Focus of questions
1	Steve Crumb, Executive Director, GENIVI Alliance	Skype call	23.10.2014	Organizational structure, reasons for founding, coopetition, funding, free-riding, expected influence on automotive industry
2	Jeremiah Foster, Community manager, GENIVI Alliance	Skype call	11.11.2014	User-driven vs. developer-driven OSS communities, free-riding, content of contributed software, future of OSS community
3	Ralph Mueller, Managing Director Europe, Eclipse Foundation	Phone call	20.11.2014	Organizational structure, reasons for founding, autonomous vs. affiliated OSS organizations, future of OSS community
4	Claus-Peter Wiedemann, Lead License Review Team, GENIVI Alliance	Phone call	21.11.2014	Tasks, license review team, coopetition, competition with similar organizations, future of OSS community
5	Joel Hoffmann, Director of Marketing and Board Director of GENIVI	Skype call	01.12.2015	Founding GENIVI community, automotive industry, reasons and goals of the alliance, comparisons to Linux Foundation
6	Jeremiah Foster, Community manager, GENIVI Alliance	Google Hangouts	17.11.2015	Code quality of GENIVI, contributors, founding and financial situation, coopetition, comparisons to Linux Foundation
7	Gaël Blondelle, Director of European Ecosystem Development, Eclipse Foundation and PolarSys expert	in person	02.11.2015	Founding reasons of PolarSys, organizational structure, long-term-support, difficulties
8	Etienne Juliot, elected participating member representative, PolarSys	in person	03.11.2015	Founding reasons, reasons to affiliate, advantages and disadvantages of PolarSys being in the Eclipse Foundation, Contributors
9	Dominique Toupin, representing Ericsson and chairman of the GENIVI Alliance	in person	03.11.2015	Long-Term-Support, dependencies to the Eclipse Foundation, advantages and disadvantages being in the Eclipse Foundation, crucial points in the beginning

Table 1: Interviews with community members of GENIVI, PolarSys and Eclipse.

Appendix

Association	Document type	Title	Pages	Date	Available on
GENIVI	Legal	Bylaws	37	Oct 2011	www.genivi.org
GENIVI	Legal	Intellectual Property Rights Policy	13	Feb 12	www.genivi.org
GENIVI	Legal	Participation Agreement	2	Jan 12	www.genivi.org
GENIVI	Legal	Public Policy for GENIVI Licensing and Copyright Version 1.6	13	n.a.	www.genivi.org
GENIVI	Organizational	1. Functional Organization Chart			www.genivi.org
		2. Instructions for Obtaining Membership	n.a.	Sep 12	www.genivi.org
		3. Membership Value			www.genivi.org
		4. Compliance Programs			www.genivi.org
Eclipse	Legal	Eclipse Bylaws	23	Aug 11	www.eclipse.org
Eclipse	Legal	Eclipse Intellectual Property Rights	11	Jul 11	www.eclipse.org
Eclipse	Legal	Eclipse Membership Agreement	11	Apr 08	www.eclipse.org
Eclipse	Legal	Eclipse Public License V 1.0	4	Apr 09	www.eclipse.org
Eclipse	Legal	PolarSys Industry Working Group Participation Agreement	8	Feb 12	www.eclipse.org
Eclipse	Organizational	Eclipse Types of Membership	n.a.	n.a.	www.eclipse.org
Eclipse	Organizational	Eclipse Membership Rights	n.a.	n.a.	www.eclipse.org
Eclipse	Organizational	PolarSys Working Group Charter	n.a.	Dec 15	www.eclipse.org
Eclipse	Organizational	PolarSys Members	n.a.	n.a.	www.polarsys.org
Eclipse	Organizational	PolarSys/TLP Proposal	n.a.	Sep 12	www.eclipse.org
Eclipse	Organizational	2014 Annual Eclipse Community Report	n.a.	Jun 14	www.eclipse.org

Table 2: Analyzed documents from GENIVI, PolarSys and Eclipse.